DRAFT ENVIRONMENTAL IMPACT STATEMENT – JUNE 1991

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FRESH CREEK ESTATES

TECHNICAL MEMORANDUM TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

June 1991

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INTRODUCTION

AKRF, Inc. was retained to conduct a comprehensive environmental assessment of the Fresh Creek Estates site in Brooklyn, New York. The location of the site is shown in Figure 1. This assessment is being conducted as part of an overall environmental review under the New York City Environmental Quality Review (CEQR) process with Departments of City Planning (NYCDCP) and Environmental Protection (NYCDEP) acting as co-lead agencies. DEP has technical responsibility for investigating the potential of contaminated materials on the site. The site was originally marshlands and was landfilled during the early 1900's. Ash and residue from a city solid waste incinerator was used as fill material. Prior to 1950 a gasoline station at the corner of Pennsylvania and Flatlands Avenues and two small wooden stables occupied parts of the site. Automobile junkyards were also once located on portions of the site.

The objectives of this assessment were to establish baseline soil and ground-water quality conditions and to evaluate the potential impact posed by existing subsurface conditions on the planned building activities at the site. In order to meet these objectives, the assessment involved conducting a soil-gas investigation, an electromagnetic survey, excavation of three test pits, soil sampling at ten boring locations, installation and sampling of five monitoring wells, laboratory analysis of soil and ground-water samples, and slug tests to compute ground-water coefficients. In all, 24 soil samples and five ground-water samples were collected from the site. They were analyzed for volatile and semivolatile organic compounds, total petroleum hydrocarbons (TPH), and metals. In addition, water samples were analyzed for total dissolved solids, hexavalent chromium, and chloride. AKRF's role was to conduct these field activities and evaluate the analytical results from the field and laboratory.

Results of the sampling and analytical work are presented in this report with our conclusions regarding site conditions and their potential impact to the proposed project. All work and quality assurance/quality control (QA/QC) was performed in accordance with a protocol reviewed and approved by DEP. A DEP representative also conducted field visits during the sample collection.

METHODOLOGY

SOIL-GAS SAMPLING

A soil gas survey was performed at the site to determine the volatile organic compound (VOC) distribution in soil and to identify potential areas of VOC contamination. The survey was conducted over the former gas station portion of the site utilizing a 25-foot grid, which resulted in 34 sampling locations. These are shown in Figure 2. The investigation consisted of sampling and analysis of soil gas from the pore space of the unsaturated zone. These compounds originate from natural organic material such as plant material in the original marsh, or from contaminants with high volatile content, such as gasoline. Soil gas moves horizontally and vertically through the soil, eventually dissipating to the atmosphere, or in some cases, becoming trapped beneath an impermeable surface such as asphalt.

To allow for collection of representative soil gas samples, the probe was placed utilizing the following procedure.

- A hole was drilled through the surface asphalt and/or soil to approximately one foot below grade using a carbide bit with no lubricant. An organic vapor analyzer (OVA) and combustible gas indicator (CGI) were used to obtain background ambient readings which were recorded in the field notes.

- After drilling was completed, the sampling apparatus -- a 5/8 inch diameter stainless steel shaft with a hardened point and slotted intakes -- was driven with a manual slide hammer to a depth of approximately three feet below grade.

- A vacuum source was applied to the sampling probe head and the system purged for at least one minute to allow the collection and subsequent analysis of a representative sample of soil gas. The vacuum pressure and release time in the system was measured and recorded. Typically, the soil's permeability is indicated by the vacuum release time rather than the vacuum pressure. A short vacuum release time indicates that soil gas flows freely from the vadose zone to the sampling probe; a long vacuum release time indicates a high resistance to soil gas transport. The latter results in a VOC concentration reading below the actual level. After purging was complete, the vacuum source was removed.

The sampling probe was then attached directly to an organic vapor meter (OVM), which recorded the total non-methane organic vapor concentration.

Some organic vapors are explosive within specific concentration ranges in combination with oxygen content. Therefore, the CGI was utilized to record the explosivity potential (expressed as percentage of the lower explosive limit (%LEL)) of the soil gas, and to also determine the oxygen content of the vapor, which, if low, may affect organic vapor and %LEL readings.

The probe was then attached to the OVA in survey mode to obtain the total organic vapor reading. The OVA was then switched to the gas chromatograph (GC) mode, causing the air drawn through the probe to pass through the carbon filter which removes the non-methane component, to determine the methane content of the soil gas.

Finally, the concentration of hydrogen sulfide in the soil gas was analyzed using a Sensidyne gas sampling system with hydrogen sulfide detector tubes in the 1 to 240 parts per million (ppm) measuring range.

Results of all readings are shown in Appendix A and are discussed in the following section of this report.

Soil-Gas Quality Assurance

To prevent carry-over or cross-contamination of soil-gas samples, the sampling probe, tubing and pump were thoroughly purged and cleaned between samples by drawing atmospheric air through the system until concentrations of organic vapors were at ambient levels. Soil blockages of the slots and shaft were removed between each location. The probe was cleaned with distilled water and soap, and rinsed with distilled water if the soil was not readily removed by brushing or other physical means.

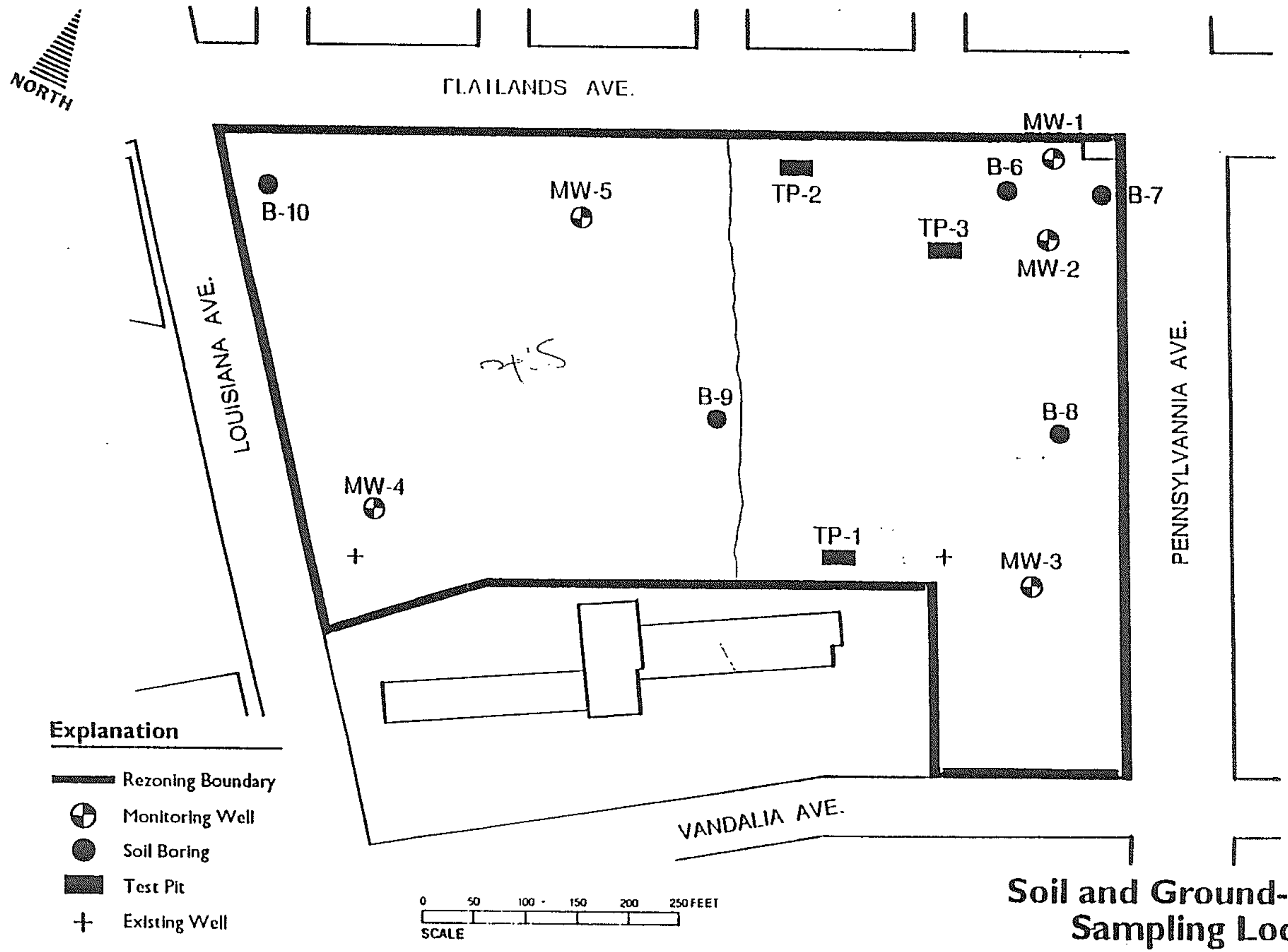
All sampling events were performed identically to the extent possible. Sample locations, dates, and values obtained were carefully noted and checked to avoid errors.

Temperature and weather conditions were also recorded because meteorological conditions can affect the flux of subsurface gases.

DRILLING/WELL CONSTRUCTION

The ground-water monitoring wells were drilled using a 6-inch hollow-stem auger. Each well consisted of two-inch inner diameter PVC casing. A 10-foot PVC screen was placed in the top eight feet of groundwater. The slot size was determined by the grain size of the soils encountered. Slot size 0.020 was used on the site. Construction logs for each well are provided in Appendix B.

A filter pack of sand was placed in the annular space around each screen and two feet above. A two-foot portion of the annular area around the well casing was sealed with bentonite pellets. A grout, consisting of a cement and bentonite mixture or an anti-shrink mixture, extends from the bentonite pellet seal to a level that is two feet below ground. The remaining annular space was sealed with a concrete cap and expanding cement well apron. The well was completed with a stand-pipe locking well cap for security purposes.



Soil and Ground-Water Sampling Locations

Figure 3

QUALITY ASSURANCE/QUALITY CONTROL

A New York State Department of Environmental Conservation (NYSDEC) Contract Laboratory Program (CLP) laboratory was used for all laboratory analyses. These laboratories operate a QA/QC program that consists of proper laboratory practices, an internal quality control program, and external quality control audits by the NYSDEC.

A field blank and trip blank were included with each day's samples to check for possible contamination from sampling activities and during transport, respectively. Field blanks were analyzed for all sample parameters and trip blanks for volatile organics. This follows standard industry practice for trip blanks, as volatile organics are the only substances that can potentially cause contamination during travel.

Matrix spikes and matrix spike duplicates were performed for every 20 samples of volatile and semivolatile organic compounds from the overall project.

For metals, a reagent blank, a duplicate, and a spiked sample were analyzed with every set of 20 samples. Standard calibration curves consisting of a minimum of a reagent blank and three (3) standards for each element were analyzed.

ELECTROMAGNETIC SURVEY

An electromagnetic (EM) survey was conducted with a GEONICS EM 31 ground-conductivity meter. EM survey is a non-invasive remote sensing technique which measures subsurface conductivities from 0 to 1,000 millimhos and is capable of detecting conductance from 0 to approximately 20 feet below land surface in the vertical dipole mode. Subsurface conductivities may be determined by measuring either the quadrature phase component (90°) or the in-phase component (180°) component of the electromagnetic field. The quadrature phase component is linearly proportional to the earth's conductivity and measures the absolute conductance of the subsurface material within its zone of influence. The in-phase component is not directly related to earth's conductivity and measures relative conductance. However, this component is significantly altered by highly conductive objects and is, therefore, typically more sensitive to buried metals.

Survey lines were set up perpendicular to Pennsylvania Avenue at 50-foot intervals. Conductivity readings were recorded at 5 second intervals using an Omnidata Digital Polycorder. The EM 31 was operated in the vertical dipole mode, and both quadrature phase and in-phase readings were measured.

Three test pit locations were chosen based on the EM survey results. These locations were confirmed in the field on the day of excavation using the EM 31.

SLUG TESTS

Slug tests were conducted on the five newly-installed ground-water monitoring wells to determine a representative estimate of permeability or hydraulic conductivity (K) of the unconsolidated materials beneath the site. The

HYDROGEOLOGY

HYDROLOGIC SETTING

The major geologic units below the project site correspond to hydrologic units with specific water-bearing characteristics. These hydrologic units, their corresponding geologic names and depths relative to National Geodetic Vertical Datum (NGVD) are as follows:

Depth Interval (relative to NGVD)	Geologic Unit	Hydrologic Unit
+20 ft to -100 ft	Upper Pleistocene deposits	Upper Glacial aquifer
-100 ft to -150 ft	Gardiners Clay	Gardiners Clay
-150 ft to -250 ft	Jameco Gravel	Jameco aquifer
-250 ft to -400 ft	Magothy Formation	Magothy aquifer
-400 ft to -500 ft	Lloyd Sand	Lloyd aquifer
-500 ft and below	Crystalline Bedrock	Crystalline Bedrock

The unconsolidated materials underlying the site were found to comprise miscellaneous fill of unknown depth containing sand, gravel, clay, bricks, organic material, concrete, glass and asphalt. Boring logs, provided in Appendix B, indicate that the deepest well penetrated to 28 feet below land surface (-2.5 NGVD). Based on sample core log descriptions it cannot be determined whether any boring penetrated the underlying glacial aquifer. However, regional maps and reports indicate that ground water in the fill is most likely in direct contact with the glacial deposits because there is no significant confining bed reported to be in the upper geologic deposits in this area. Therefore the fill and underlying aquifer appear to be hydraulically connected.

Ground water occurs under unconfined (water-table) conditions between 12.67 and 22.82 feet below grade (2.79 ft to 4.00 ft above NGVD). The water-table configuration, based on data collected on May 8, 1991, is presented in Figure 4. The contour lines show that ground water generally flows south discharging into Fresh Creek. The direction of ground-water flow at the site is in general agreement with published water-table data provided by the U.S. Geological Survey (Doriski, 1984). The slightly lower water-level elevation in MW-1 as compared to MW-2 may be caused by the well screened in a slightly less permeable material. This theory is supported by the difference in calculated hydraulic conductivities in the following slug test section. Well EW adjacent to MW-4 was not installed by AKRF. Construction details were not available and the integrity of the well is unknown. Only water level data were collected from this well.

SLUG TEST RESULTS

The calculated values of hydraulic conductivity in feet per day from each monitoring well are as follows:

MW-1:	19 ft/day
MW-2:	62
MW-3:	311
MW-4:	24
MW-5:	32
Average K:	90 ft/day

In comparison, the estimated average hydraulic conductivity for the upper glacial aquifer on Long Island is 270 ft/day (Buxton and others, 1981), and generally ranges from 53 to 400 ft/day, (McClymonds and Franke, 1972). Therefore, the values obtained at the site are reasonable considering that the five wells may be screened in upper glacial deposits (mainly sand and gravel), or fill, or both, which could decrease K.

Ground-water gradients were calculated based on measured water elevations and horizontal distances between wells. The computed values range between 7.6 $\times 10^{-4}$ and 1.3 $\times 10^{-2}$ ft/ft with an average of 5 $\times 10^{-3}$ ft/ft. Using the above information, ground-water velocities were estimated using the equation $v = Kdh/ndl$ where v= average velocity, in ft/day, n= porosity (0.30), and dh/dl is the average hydraulic gradient. The computed value of the average horizontal rate of ground-water movement in the subsurface material is approximately 1.5 ft/day, the same as for published values of the upper glacial aquifer in Queens County (Soren, 1971).

determine whether the presence of a contaminant represents a significant threat to public health and the environment. Thus, they represent a screening tool in different situations. Detailed evaluation, including risk analysis, would use different criteria. For example, areas used as playgrounds are evaluated differently than areas that would be paved or used for industry. For this reason, the levels are generally set at conservatively low values, indicating a need for further consideration and not establishing a need for mitigation or remediation. The metals tables also include the typical background ranges of certain analytes as provided by the U.S. Geological Survey (USGS).

For the purposes of this report, the soil samples are discussed in terms of surface and subsurface findings. Based on the proposed project plan, all surface areas and many subsurface areas will be disturbed by grading and/or excavation during site preparation. Soil will be removed from the site due to a nearly site-wide decrease in elevation, according to construction plans. Site elevations obtained from a 1990 topographic survey were compared to the proposed project elevations to determine which subsurface areas would potentially be exposed during excavation and grading. Subtraction of proposed elevations from surveyed elevations and comparison with sample depths indicate that subsurface samples MW-1:4-6, MW-2:6-10, B-6:4-6, and B-7:4-8 are in areas which will be excavated based on current plans. Other subsurface samples were taken below the depth of proposed excavation or grading.

Total Petroleum Hydrocarbons

The most prevalent contaminant on the site is TPH, which exceeded the NYCDEP guidance value in all but one sample. Over half of the soil samples contained TPH concentrations one order of magnitude above the NYCDEP guidance value of 100 ppm. The concentrations covered a wide range -- from 91 to 25,900 ppm. As shown on Figure 5, elevated TPH values are randomly distributed and are presumably associated with the fill material placed on the site in the 1940's.

TAL Metals

The NYCDEP guidance values differ for specific metals. Guidance values and analytical results are shown in Table 2. Exceedances were found for arsenic, barium, chromium, copper, lead, mercury, and zinc. As with TPH, occurrences are random, although subsurface samples and the north-eastern and southern corner of the site appear to contain a greater extent of metals. This is not apparently related to any activities in the site history. As with TPH, the metals may be associated with the fill material.

Arsenic

Arsenic concentrations were, for the most part, below the NYCDEP guidance value of 9 ppm, except at four locations that exceeded this concentration by less than 4 ppm: MW-4:16-18 (11.8 ppm), B-8:18-23 (11.8 ppm), TP-2 (9.3 ppm), and TP-3 (11.5 ppm). These values are all within the background range for arsenic. The two test pit areas in the northern part of the site will be encountered during site preparation activities.

[illegible] CDEP guidance value for barium is 400 ppm. The samples from MW- [illegible] 0-2 and 16-18, B-7:4-8, B-8:18-23, TP-2, and TP-3 exceeded this [illegible] hest concentration, of 1,610 ppm, was detected at MW-3:19-21, an [illegible] not be exposed according to the proposed construction plans. All [illegible] contained less that 1,000 ppm, with concentrations ranging from 546 [illegible] reas that may be potentially encountered during site preparation

[illegible] CDEP guidance value for chromium is 46 ppm. Elevated values were [illegible] W-2:0-2 (62 ppm), B-8:18-23 (67.4 ppm), and B-9:14-17 (111 ppm). [illegible] of potential exposure, however the reported concentration is only [illegible] the guidance value and within the background range for chromium [illegible] oils.

[illegible] CDEP guidance value for copper, 170 ppm, is exceeded by samples from [illegible] W-5:10-12, B-8:18-23, B-9:14-17, and TP-2. The highest [illegible] 1,580 ppm, was at MW-4. The remainder were below 520 ppm. The [illegible] in an area of potential exposure, contained 241 ppm of copper.

[illegible] CDEP guidance value for lead ranges from 500 to 1,000 ppm. Areas [illegible] may be in contact with site soils are viewed more conservatively. [illegible] sample from B-8, and all three test pit samples exceeded 500 ppm. [illegible] amples with concentrations greater than 500 ppm are MW-3:19-21, B- [illegible] 8:18-23, with only the sample from B-6 potentially exposed. Lead [illegible] at 660 ppm in B-6. All of the locations are on the north-eastern [illegible] the site.

[illegible] CDEP guidance value for mercury is 1 ppm. A value of 1.02 ppm was [illegible] TP-3. Subsurface samples from MW-1 and B-8 contained 4.1 and 3.1 [illegible] ively. The subsurface area at MW-1 in the northern corner of the [illegible] exposed during excavation.

Zinc

[illegible] CDEP guidance value for zinc, 350 ppm, is exceeded at MW-2:6-10, MW- [illegible] 0-2, MW-4:16-18, MW-5:10-12, B-8:18-23, B-9:14-17, TP-2, and TP-3. [illegible] ranged from 413 to 2,150 ppm. MW-2, TP-2 and TP-3 are located in [illegible] corner of the site, with concentrations of 1,330, 915, and 1,310 [illegible] ively. These areas will be encountered during site preparation. MW- [illegible] uthern corner of the site, also showed elevated zinc concentration [illegible] the surface sample, although not as high as samples obtained from [illegible] corner of the site. The MW-4 subsurface area will not be exposed.

Semivolatiles are present at greater than guidance values at three subsurface locations, but are not associated with carcinogenic PAHs. According to proposed elevations shown on the project plans, these areas will not be exposed during grading.

CONTAMINANT ASSESSMENT: GROUND WATER

Ground-water samples were collected from the five monitoring wells installed by AKRF. The levels of analytes detected in ground-water samples have been compared with NYSDEC standards and guidance values for Class GA waters. These values are intended for potable water supplies but are generally applied to all non-saline ground water as an indicator of quality. Ground water is defined as saline if the chloride concentration is greater than 250 ppm or the total dissolved solids (TDS) concentrations exceeds 1,000 ppm. Class GA standards include compounds that may affect human health and non-toxic compounds that may decrease the aesthetic quality of the water. It should be noted that the ground water is not used as drinking water in the area, nor will excavations on the site reach the water table.

TAL Metals

Concentrations of metals in ground water were measured in filtered and unfiltered samples. The analyses of filtered samples determined the quantities of metals dissolved in the ground water. The analyses of the unfiltered samples determined the quantities of soluble and insoluble metals in the samples. Concentrations of metals in the soils are much greater than the dissolved concentrations in the ground water. Most metals do not readily dissolve in water, but will preferentially adsorb onto the soil particles. Therefore total (i.e., unfiltered) metals analyses result in much higher readings than concentrations actually dissolved in the ground water. It is important to note that solids (and their associated contaminants) do not move with the ground water. Nevertheless, DEC-regulated limits are established on the basis of total metals.

Concentrations of ten total metals exceeded GA standards or guidance values in one or more wells, as shown in Table 7. Iron, lead, and manganese were above their respective standards of 300, 25, and 300 parts per billion (ppb) in all five wells. Barium was in exceedance of the 1,000 ppb standard in all wells except MW-1. Zinc was elevated above the 5,000 ppb standard in MW-2, MW-4, and MW-5. Magnesium exceeded the 35,000 ppb guidance value in MW-3, MW-4, and MW-5. Arsenic, cadmium, and copper were in exceedance of their respective standards of 25, 10 and 1,000 ppb in MW-4 and MW-5. Beryllium exceeded the guidance value of 3 ppb in MW-3.

Concentrations of most metals in filtered water were significantly lower (Table 8). However, there were exceedances of GA standards. Manganese was elevated in all wells except MW-4. Magnesium was in exceedance of the guidance value in MW-3, MW-4, and MW-5. Iron was elevated in MW-3 and MW-5. Lead was in exceedance in MW-3. Barium was elevated to just above the standard in MW-4.

Summary

The ground water beneath the site is not used for human consumption nor will it be encountered during the construction. Contaminants that are present at elevated levels are probably associated with the fill material or with suspended soil particles. Most metals found in the filtered samples are naturally-occurring constituents in ground water. Manganese and phenols are in exceedance in MW-1, an upgradient well, which may indicate that these substances are originating off-site. Other semivolatile organic compounds that exceeded GA standards or guidance values are either present in method blanks or may be associated with suspended soil particles. Semivolatiles detected in MW-4 may be dissolved in the ground water. Volatile organic compounds were slightly elevated in only MW-4, and, based on soil analyses, do not appear to be associated with the fill material. There is no apparent source for the volatile compounds.